Theory of Computer Science

G. Röger
Spring Term 2019

University of Basel
Computer Science

Exercise meeting 7

Exercise 7.1

Specify the Turing machine M_w encoded by:

$$w = 1111001100110011011101001111001101001100110100110011110011011101110011001101$$

Is $w \in K$, i.e. does M_w started on w terminate?

Exercise 7.2

Let A and B be two problems, and $A \leq B$. What can be said about

(a) B, if A is decidable?

(b) B, if A is semi-decidable?

(c) B, if A is undecidable?

(d) B, if A is not semi-decidable?

(e) A, if B is decidable?

(f) A, if B is semi-decidable?

(g) A, if B is undecidable?

(h) A, if B is not semi-decidable?

Exercise 7.3

The *equivalence problem* EQUIVALENCE for general (type-0) grammars is defined as:

Given two general grammars G_1 and G_2, is $\mathcal{L}(G_1) = \mathcal{L}(G_2)$?

Show that EQUIVALENCE is undecidable by reducing EMPTINESS to it. The *emptiness problem* EMPTINESS for general (type-0) grammars is defined as:

Given a general grammar G, is $\mathcal{L}(G) = \emptyset$?

(We show that EMPTINESS is undecidable in the next exercise sheet.)